STEPHANOCRINUS ANGULATUS CONRAD (CRINOIDEA) FROM THE SILURIAN OF KASHMIR

by V. J. GUPTA *and* G. D. WEBSTER

ABSTRACT. The crinoid *Stephanocrinus angulatus* Conrad is reported from the lower part of the Naubug Beds of Kashmir. This represents the first record of *Stephanocrinus* from Asia and corroborates a Silurian age for the lower part of the Naubug Beds.

Stephanocrinus angulatus Conrad has been recognized for many years as a Middle Silurian index fossil in North America. Discovery of this crinoid in Kashmir, in strata of Late Silurian age, significantly extends its known palaeogeographic and geologic range.

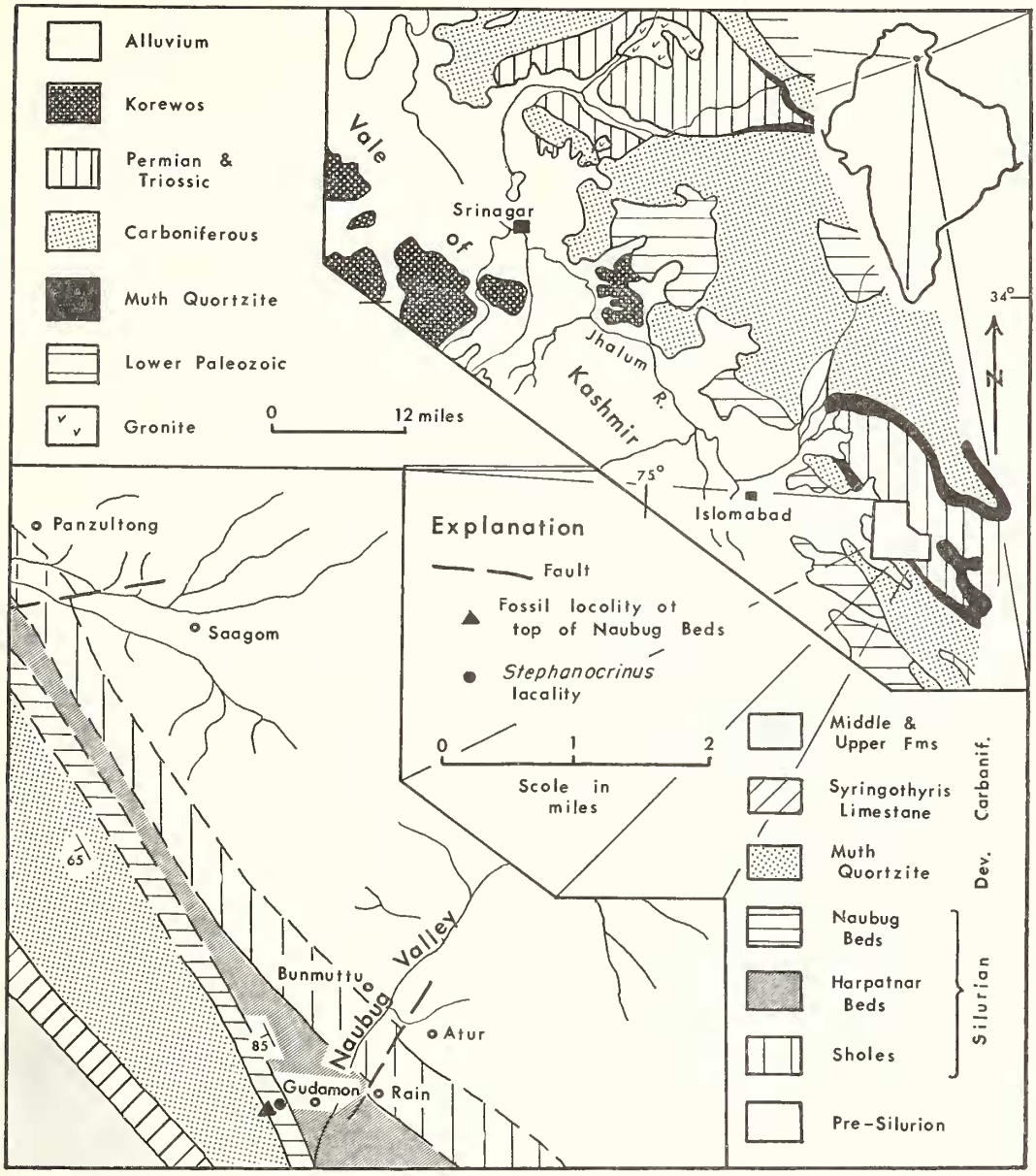
The Palaeozoic section east of Islamabad (Anantnag), Kashmir is moderately well exposed in the flanks of a north-west plunging anticline (text-fig. 1). Silurian fossils have previously been reported from the Harpatnar and Naubug Beds. The Harpatnar Beds contain graptolites of an early to middle Ludlow age (Berry and Gupta 1966). A diverse fauna including brachiopods, trilobites, nautiloids (Reed 1912), crinoids (Sahni and Gupta 1965), fishes, conodonts, and corals (Gupta 1969*a*) have been found in the sandy calcareous shales of the upper part of the Naubug Beds. In addition, Gupta recently found five dorsal cups of *Stephanocrinus angulatus* Conrad in the lower part of the Naubug Beds. This diverse fauna suggests a Late Silurian–Early Devonian age for the upper part of the Naubug Beds (Gupta 1969*b*). The Naubug Beds are conformably overlain by the Muth Quartzite which has yielded brachiopods, corals, trilobites, pelecypods, and fishes of early Middle Devonian age (Gupta 1969*c*).

SYSTEMATIC PALAEONTOLOGY

Phylum ECHINODERMATA
Subphylum CRINOZOA Matsumoto 1929
Class CRINOIDEA J. S. Miller 1821
Order CORONATA Jaekel 1921
Family STEPHANOCRINIDAE Wachsmuth and Springer 1887
Genus STEPHANOCRINUS Conrad 1842
Stephanocrinus angulatus Conrad 1842

1891 *Stephanocrinus obpyramidalis* S. A. Miller, p. 634, pl. 6, fig. 6.
?1892 *Stephanocrinus cornetti* S. A. Miller, p. 12, pl. 2, figs. 10–12.
1915 *Stephanocrinus angulatus* Conrad; Bassler, p. 1187 (see this reference for lengthy synonomy prior to 1915).
1926 *Stephanocrinus angulatus* Conrad; Springer, p. 139, pl. 31, figs. 13–16.
1961 *Stephanocrinus angulatus* Conrad; Fay, p. 236, pl. 1.
1962 *Stephanocrinus angulatus* Conrad; Fay, p. 206, pl. 35, text fig. 1.

[Palaeontology, Vol. 14, Part 2, 1971, 262–5, pl. 39.]



TEXT-FIG. 1. Detailed geological map of the Naubug Valley area, showing the position of the fossil localities in the Naubug Beds. Inset map shows the generalized geology of the Vale of Kashmir and the location of the Naubug Valley area, east of Islamabad (Anantnag) with reference to the Indian subcontinent.

Description. An adequate description of *Stephanocrinus angulatus* was given by Hall (1852, p. 212) and significant morphological data were added by Fay (1961, p. 236; 1962, p. 206). Therefore only a brief description of the Naubug specimens is given for comparison purposes.

Dorsal cup elongate pyriform, base triangular, stem impression round. Basals 3, radials 5, interradials 5, no other plates preserved. Ornamentation twofold, coarse sharp oblique ridges extending from base of cup to summit plane and fine transverse ridges and grooves from base of cup to tips of coronal processes. Measurements of three specimens are given in Table 1.

TABLE 1. Measurements in millimetres of *Stephanocrinus angulatus* Conrad from the Naubug Beds of Kashmir.

Specimen number	*Height*	*Width max.*	*Width min.*	*Width av.*	*H/W ratio*
F 1310	14·1	9·0	7·4	8·2	1·72
F 1311	14·8	8·6	6·7	7·65	1·94
F 1312	13·7	8·7	6·8	7·75	1·77

Comments. A review of the illustrated specimens of *Stephanocrinus angulatus* revealed that the species is quite variable in proportions. Height to width ratios range from 1·5 to 3. There is also some variation in the prominence of the coarse linear ridges which are always present. The fine transverse ridges and grooves are sometimes masked by matrix material. *S. obpyramidalis* S. A. Miller is thought to be a slightly abraided specimen of *S. angulatus*. *S. cornetti* S. A. Miller is questionably considered a very elongate form of *S. angulatus*.

In North America the range of *Stephanocrinus angulatus* is middle through upper Niagaran or approximately equivalent to the Wenlockian and lower Ludlovian of the British standard section. Ranges of all other species of *Stephanocrinus* are within this same span from North America. Bather (1900, pp. 96, 145) has also recorded the genus from the Silurian of England. The Naubug specimens of *S. angulatus* are the first reported from Asia and can be no older than early or middle Ludlow age because graptolites of that age have been found in the underlying Harpatnar Beds. The stratigraphic position and associated fauna of the lower part of the Naubug Beds suggests a middle or late Ludlow age thus slightly extending the recognized range of *S. angulatus*.

Material. All specimens are deposited in the Museum of the Geology Department, Panjab University, Chandigarh, India, and bear the catalogue numbers PUGD F 1310–14. Three of these are illustrated in Plate 39. Figure 9 is a line sketch made by Gupta and the other specimens were coated with ammonium chloride before photographing.

EXPLANATION OF PLATE 39 (*pars*)

(see opposite p. 256)

Stephanocrinus angulatus Conrad.

Figs. 6–8, specimen PUGD F1311, A ray, B ray, and oral views, ×2; 9, specimen PUGD F1312, line sketch of lateral view, ×3; 10–12, specimen PUGD F1310, oral, A ray, and C–D interray views, ×2. All specimens from the lower part of the Naubug Beds, Kashmir.

Locality. All specimens are from the upper part of a 100-ft thick succession of thinly bedded blue-grey to rusty calcareous sandy shales in the lower part of the Naubug Beds, which are poorly exposed above the west bank of the Naubug River on Bumtung Ridge, approximately one mile north of the village of Naubug, Kashmir, India. Co-ordinates of the fossil locality are longitude 33° 40′ 30″ N and latitude 75° 23′ 00″ E.

REFERENCES

BASSLER, R. S. 1915. Bibliographic index of American Ordovician and Silurian fossils. *U.S. Nat. Mus. Bull.* **92.** 1521 pp.

BATHER, F. A. 1900. In *A Treatise on Zoology*, ed. LANKESTER, E. RAY, Part III. The Echinoderma. London.

BERRY, W. B. N. and GUPTA, V. J. 1966. Monograptids from the Kashmir Himalayas. *J. Paleont.* **40,** 1338–44, pl. 167.

FAY, R. O. 1961. The type species of *Stephanocrinus* Conrad. *Okla. Geol. Notes*, **21,** 236–8, pl. I.

—— 1962. Ventral structures of *Stephanocrinus angulatus* Conrad. *J. Paleont.* **36,** 206–10, pl. 35.

GUPTA, V. J. 1969*a*. Lower Palaeozoic stratigraphy of the area southeast of Srinagar. *Panjab Univ. Res. Bull.* N.S. **20,** 1–13.

—— 1969*b*. Silurian–Devonian boundary in the Kashmir Himalayas. *Bull. Geol. Soc. India*, **6,** 26–7.

—— 1969*c*. The stratigraphy of the Muth Quartzite of the Himalayas. *J. Geol. Soc. India*, **10,** 88–94, 2 text-figs.

HALL, J. 1852. *Natural History of New York. Paleontology*, pt. 6, vol. 2. 362 pp., 85 pl.

MILLER, S. A. 1891 (advance publication). *17th Ann. Rept. Geol. Surv. Indiana.* 705 pp., 20 pl.

—— 1892 (advance publication). *18th Ann. Rept. Geol. Surv. Indiana.* 365 pp., 12 pl.

REED, F. R. C. 1912. Silurian fossils from Kashmir. *Rec. Geol. Surv. India*, **42,** 16–33, pl. IX.

SAHNI, M. R. and GUPTA, V. J. 1965. Silurian crinoids from the Kashmir Himalayas. *Panjab Univ. Res. Bull.* N.S. **16,** 247–8, 1 text-fig.

SPRINGER, F. 1926. American Silurian crinoids. *Smithsonian Inst. Pub.* **2871,** 239 pp., 33 pl.

V. J. GUPTA
Panjab University
Chandigarh
India

G. D. WEBSTER
Washington State University
Pullman
Washington, U.S.A.

Typescript received 26 June 1970